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THE HISTORY OF THE DISCOVERY OF
ANÆSTHESIA.

BY BURNSIDE FOSTER, M. D.



FIFTY YEARS OF SURGERY UNDER
ANÆSTHESIA.

BY THEODORE F. DEWITT, M. D.

Papers read at the Semi-Centennial Celebration of the Dis-
covery of Anæsthesia, at the University of Minnesota,
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THE HISTORY OF THE DISCOVERY OF ANÆSTHESIA.*

BY BURNSIDE FOSTER, M. D.

St. Paul.

It is surely an inspiring and a stimulating custom which prevails among cultivated persons of all countries, and which prompts them to gather together on the anniversaries of great events, to recall the memories of the past, and to honor the names of those who have achieved great deeds, who have made great epochs in the history of the world. We love to celebrate the birthdays of our great soldiers and statesmen; we love to celebrate the anniversaries of great victories on the field of battle; what then could be more fitting than that we should be gathered together today to celebrate the fiftieth anniversary of the victory of science over pain, the fiftieth anniversary of the greatest epoch in the history of medicine, the fiftieth birthday of anæsthesia.

Fifty years ago today there assembled in the Amphitheatre of the Massachusetts General Hospital in Boston an unusually large number of the medical students and physicians of the city; for it was public operation day, and it had been whispered abroad that a wonderful experiment was going to be made; that a patient was to undergo a

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severe operation while in a state of artificially produced sleep; sleep so profound that no pain could disturb it. Can you not imagine the sensation which such a rumor must have produced? Fortunately we can, none of us, remember the horrors of surgery before that time; when patients were often dragged, shrieking with fear, to the operating table, and there were strapped down to undergo the torture of the surgeon's knife. No wonder, then, that there was an eager throng of men to witness the beginning of the end of painful surgery. I do not suppose, however, that a single person of all who were present on that occasion, most of whom are now dead, fully realized what the events of that day were destined to bring forth, to the glory of surgery and to the happiness of mankind. In that same amphitheatre, every nook and corner of which is familiar to me, for it was there that I received my first lessons in surgery, the very sponge from which ether was first inhaled is carefully preserved in a glass case, and is regarded as the most precious historical relic of that venerable institution. In that same amphitheatre today there are gathered together, as we are here, a great assemblage of physicians, students of medicine and citizens, to rehearse the story of the birth of anæsthesia, and to do honor to the memory of those who gave it to the world, and who robbed surgery of its greatest terror and maternity of its pain.

Before describing what took place in that historical old amphitheatre a half century ago today,

it will, perhaps, be interesting to look backwards a little farther and to scan somewhat hastily the events which led up to this, the grandest discovery in the whole history of medicine. From the very earliest times of which we have any record men sought to produce an insensibility which would conquer pain. The accessible literature of the ancient Greeks, the Egyptians, the Scythians, the Assyrians, and even of the Chinese all records attempts, some of them more or less successful, to dull sensibility by the use of drugs.

Mandragora, a drug now obsolete and its very nature almost unknown, is mentioned in Grecian literature as capable of producing an insensibility which would permit even of a painless amputation. It has been suggested that it was this very drug which Shakespeare had in mind when he makes Friar Laurence prescribe a sleeping draught for Juliet, and tell her that

“Presently, through all thy veins, shall run
A cold and drowsy humour which shall seize
Each vital spirit; for no pulse shall keep
His natural progress, but surcease to beat,
No warmth, no breath shall testify thou livest;
The roses in thy lips and cheeks shall fade
To paly ashes; thy eyes’ windows fall,
Like death when he shuts up the day of Life,
And in this borrowed likeness of shrunk Death
Thou shalt continue two and forty hours!”

One of the early Italian surgeons, *Theodorie*, who lived in Dante’s time, practised the inhalation of some vapor from a sponge saturated with a mixture of opium, hyoscyamus, hemlock and lettuce to produce insensibility. It has also been

recorded that an Italian of the thirteenth century produced an *aqua ardens* from red wine and common salt, which, being inhaled, would induce a heavy sleep. We may also read in ancient medical writings of attempts to produce local insensibility by mechanical means, such as the compression of nerves, and by freezing the surface of the body. It was not, however, until the end of the last century that the first suggestion of modern anæsthesia was made by the experiments of Humphrey Davy, in England, with nitrous oxide gas. The chemical and physiological properties of sulphuric ether began to be somewhat vaguely known at about the same time.

Another half century, however, was destined to elapse before any practical results were achieved towards the accomplishment of that for which many earnest workers had striven for many centuries. There are four names which must always be associated with the final demonstration of the safety and practicability of surgical anæsthesia: Horace Wells, of Hartford, Conn., Crawford W. Long, of Georgia, Charles Thomas Jackson and William Thomas Green Morton, both of Boston. It is not my purpose, nor indeed would it profit us even if I had the time, to enter into the details of that bitter controversy between these four men as to which of them was entitled to the honor of being the discoverer of the anæsthetic properties of ether. I will content myself with stating that, while a careful study of the history of the subject proves beyond a doubt that Crawford Long per-

formed the first operations upon patients rendered insensible by ether narcosis, the honor of the first public demonstration of the safety and practical value of the use of ether in surgery belongs to Morton! It was Morton who gave it to the world!

There is no doubt that Dr. Long, during the years 1842, 1843 and 1844, performed a number of operations under ether, but as he lived in a part of the country remote from medical journals and societies, and as he did not seem at first to fully appreciate the significance and the importance of his observations and experience, he failed to report or to record his knowledge until some years after Morton, who had never heard of Long or his work, had publicly proven that operations could be painlessly performed upon patients who had been rendered insensible by inhaling ether.

William Thomas Green Morton was born in Worcester county, Massachusetts, August 19, 1819, and spent his early years upon a typical New England farm, receiving his preliminary education at the famous old Leicester Academy. At the age of seventeen he went to Boston to earn his living, but having from his boyhood shown a great aptitude for scientific pursuits, he found commercial life uncongenial, and determined to study dentistry, which was then just attaining the dignity of an important branch of surgery, and becoming recognized as a respected profession. He went to Baltimore, where the first dental college in America had recently been established, and, after graduating, he returned to Boston, where he speed-

ily acquired an extensive and a lucrative practice. His tremendous energy and capacity for work was shown by the fact that, besides attending to a large office practice, he found time to attend the lectures at the Harvard Medical School, for he was desirous of obtaining the degree of Doctor of Medicine. From the beginning of his professional life Morton was possessed with the idea that he was destined to discover some method by which insensibility to pain might be produced. He had experimented somewhat with nitrous oxide gas, the properties of which he had learned from Dr. Horace Wells, with whom he had been for a time associated in the practice of his profession. In a conversation with Dr. Jackson, with whom his medical studies had brought him into somewhat intimate personal relations, in regard to the manufacture of nitrous oxide, Morton received the suggestion that sulphuric ether might accomplish the same purpose. He immediately began to experiment with it upon animals, upon such persons as he could persuade to submit to it, and upon himself. In spite of many discouragements and much ridicule from those who knew of his attempts, he persisted patiently, until finally he became satisfied that he could produce safely a brief period of insensibility sufficient for the ordinary operations of dentistry. Then came the question of its use in surgery. Fortunately Morton counted among his warm friends Henry J. Bigelow, who was about his own age, and who afterwards became, as you all know, one of the greatest surgeons our country or oth-

er country has ever produced. Dr. Bigelow had faith in Morton's discovery, and determined to assist him in obtaining an opportunity to give it a public trial. Finally, on the fourteenth of October, 1846, Dr. Morton received a note from the house surgeon of the Massachusetts General Hospital, written at the request of Dr. J. C. Warren, then senior surgeon, inviting him to be present on the following Friday morning, and to administer to a patient, then to be operated upon, "the preparation which he had invented to diminish the sensibility to pain." No wonder that his nights were sleepless, and his days were anxious during the brief period before the day of trial. Remember, he was but twenty-seven years of age, and comparatively unknown, and he was to appear before the most distinguished and experienced surgeons of that time to demonstrate something which seemed to them an impossibility. On the morning of that memorable day, the sixteenth of October, 1846, there were assembled, as I have said, an unusually large number of spectators in the Amphitheatre. Of all who were present on that occasion but three are believed to be now living. As the hour for the operation approached the excitement became intense, and even the surgeons seemed to share it. Ten o'clock, the hour named, had passed, and still Dr. Morton had not arrived. Slowly the minutes, five, ten, fifteen, dragged on, and then Dr. Warren, taking out his watch and smiling somewhat sarcastically, said: "Gentlemen, as Dr. Morton is not present, perhaps

it will be as well to proceed with the operation in the usual way." The patient, a young man with a tumor of the neck, was brought in and prepared, when, at the last moment, Dr. Morton, who had been delayed in his final preparations, appeared, somewhat out of breath, but cool and self possessed, and ready to proceed with his demonstration. Rapidly he proceeded to pour out the fluid, whose vapor he directed the patient to inhale, as it was held close to his face. Not a word was spoken. No sound broke the silence of that room, save the deep breathing of the patient and the restless movements of that eager and excited throng of spectators. Presently that death like stillness was broken by the quiet voice of Dr. Morton, who turned to Dr. Warren and said: "Your patient is ready, doctor," There lay the patient, apparently only in a heavy sleep; but there was probably no one present, save Morton himself, who did not expect to see him start up with a cry of pain at the first incision of the surgeon's knife. But no! Swiftly and surely the knife has cut through the skin, the blood is flowing freely, the tumor is skillfully dissected out, the vessels ligated, the wound closed with sutures, dressed and bandaged. Not a sound from the patient, who is still lying in a painless sleep! The change of sentiment from incredulity and suspicious doubt, to belief and admiration, which took place in the minds of all those who were present that day, was well voiced by Dr. Warren, who exclaimed, as the patient was being carried away: "Gentlemen, this is no humbug!"

That day's events recall to my mind those lines of Goldsmith, doubtless familiar to you all, in which, describing the preacher of "The Deserted Village," he says:

"Truth from his lips prevailed with double sway,
And fools who came to scoff remained to pray!"

What you have just listened to is believed to be an accurate account of what took place at the first public demonstration of anæsthesia. The account is taken partly from the statements of Dr. Morton's widow and partly from the testimony of one of the three living witnesses of that great event.

There is little to say further concerning the discovery of anæsthesia, which, from that day, became an established fact. Chloroform was introduced some two years later by Sir James Simpson, in England, and being somewhat pleasanter to inhale, is still preferred for short operations and for producing anæsthesia during labor, by many surgeons, although there is a certain element of danger connected with its administration, and it is not quite so safe for general use as ether.

It is undoubtedly true that Dr. Jackson, who was an eminent chemist, was familiar with the properties of sulphuric ether, as numerous other persons were, and had inhaled its vapors himself, before Morton had ever used it, but the evidence seems to show that he had not sufficiently the courage of his convictions to risk his professional reputation by publicly administering it to a human being. Morton, however, having satisfied himself of its safety and efficiency by numerous private

trials, undertook this task, solely upon his own responsibility, risking not only the ridicule and abuse, but even the greater danger of criminal prosecution which a failure, involving injury or death to the patient, might have brought upon him.

It seems to me that the revival, at this time, of the details of that unfortunate and bitter controversy between Jackson and Morton can add no lustre to the fame of either. I would rather that it should lie buried in their graves, and that for this priceless boon, for which mankind is in some measure indebted to them both, a grateful posterity should give to each his share of gratitude and glory. We who are now so accustomed to painless surgery that anæsthesia has long since ceased to excite even our wonder, can scarcely realize the bitter opposition, the obstinate hostility which for the first few years of its existence opposed its general use. Even the pulpit hurled powerful and eloquent anathemas against its advocates, declaring that pain, and particularly the pain of child-bed, was the dispensation of a Divine Providence, and that it was sacrilege, an insult to the Almighty, to make this attempt at interference with His arrangements: and there were not wanting quotations from Scripture to sustain this view. But has not this ever been the history of each great step in the progress of the world? And, indeed, a wise conservatism, which carefully scrutinizes every new and unprecedented procedure, is especially needful in medicine and surgery, to protect humanity from ignorant and dangerous ex-

perimentation. It is wise counsel to the young physician, and indeed to physicians in general, which is found in those familiar lines of Pope:

"Be not the first by whom the new is tried;
Nor yet the last to lay the old aside."

Neither Morton nor Jackson ever derived any pecuniary profit from their connection with the discovery of ether anæsthesia, although they were both honored by many scientific academies and societies and received the medals and decorations of numerous foreign orders and governments. Morton died a poor man in 1868; Jackson became insane and died in 1880.

Upon the base of the dome of the new chamber of the House of Representatives in the Boston State House are inscribed the names of the selected fifty-three of Massachusetts' most distinguished citizens. These names have been selected in such a way that each shall either mark an epoch, or designate a man who has turned the course of events. There may be read the name of William Thomas Green Morton.

Above his grave in Mt. Auburn Cemetery stands a beautiful monument erected shortly after his death by physicians and citizens of Boston. Upon it is this inscription, written by the late Dr. Jacob Bigelow: "Inventor and revealer of anæsthetic inhalation. By whom pain in surgery was averted and annulled. Before whom, in all time, surgery was agony. Since whom science has controlled pain."

FIFTY YEARS OF SURGERY UNDER ANÆSTHESIA.*

BY THEODORE F. DEWITT, M. D.

St. Paul.

Mr. Chairman, Ladies and Gentlemen:

The committee on arrangements have kindly invited me to address you briefly on the subject of "Fifty Years Progress in Surgery." This progress, which has been unparalleled in the history of surgery, has been mainly due to the introduction of anæsthesia and to the recognition of the parasitic theory of disease. Few of us, perhaps, realize how great the advance in our art during the last half century has been.

Let us consider for a moment the status of surgery prior to 1846. The resources of the surgeon for diagnosis or treatment were not what they are today. He did not use the thermometer, microscope, laryngoscope or hypodermic, and the ophthalmoscope had not been invented. He knew nothing of the cause of inflammation, and, lastly, he had no anæsthetic. Owing to the intense pain and frightful mortality attending surgical procedures in those pre anæsthetic and pre antiseptic days, surgeons confined themselves principally to operations of necessity, viz: ligations of arteries,

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amputations, removal of growths from the surface, **cutting for stone, etc.**

The operations were so fashioned as to limit the expenditure of time, and thus the suffering of the patient, to the greatest possible extent. Complicated, elaborate methods of operating, such as are now properly in vogue, would have been out of place then.

One can but feel the highest admiration for those who had the courage to be surgeons in those days. Consider the fortitude required to perform a difficult operation upon a patient shrieking with agony and struggling to free himself from the assistants. The surgeons of those days, by constant practice upon the cadaver, acquired a degree of dexterity, finish and brilliancy in the art of operating probably never seen by us, the principal necessity for such expertness having passed away with the discovery of anæsthesia. Thus, Liston would often amputate the thigh with one hand, controlling the hemorrhage by pressure on the femoral with the other; Willard Parker, in ligation of the femoral, would lay this artery bare with one stroke of the knife. James R. Wood frequently amputated the **thigh in ten seconds.**

After the discovery of anæsthesia it became the practice to plan operations more with regard to the safety and usefulness of the procedure, rapidity becoming of secondary importance. Surgeons became more deliberate, more exact and more thorough in their work. So called "conservative surgery" soon followed, largely through

the influence of William Ferguson. This term was applied principally to the avoidance of amputation by resection and to the removal of the least possible in diseased bone. Great advance in the diagnosis and treatment of fractures and dislocations also followed the discovery of anæsthesia. The muscles of the patient being relaxed by the anæsthetic, it became possible to more accurately diagnose the condition and to replace more exactly the dislocated or fractured bones.

Formerly it was the custom to reduce the dislocations by extension, a very crude and painful procedure; now reduction is frequently effected by manipulation. Humphrey very graphically describes an attempt he saw made fifty years ago by one of England's most famous surgeons to reduce a dislocated hip. The patient was fastened to the table, bled, and dosed with tartar emetic to relax the muscles. Ropes through pulleys were then attached to the patient's thigh, and an attempt, lasting several hours, was made to pull the bone into place by brute force. Finally the bone was fractured, the patient exhausted and the attempt was abandoned. This patient soon after died from the effects of this procedure. As he (Humphrey) truly remarks, "A modern surgeon would have reduced the dislocation by manipulation, painlessly and in a few minutes."

Early in the "fifties" instruments designed to aid in diagnosis, such as the ophthalmoscope and the stethoscope, began to be used, and materially aided in progress. Although surgery had now made

rapid strides, it was not until the scientist with his microscope came upon the field that anything approaching modern surgery was attained. Pain had been abolished, methods were more accurate and more conservative, but the mortality had not materially lessened. Deaths from pyæmia, erysipelas, hospital gangrene, were still the rule. It had always been supposed that inflammation and repair were part of the same process; that inflammation, indeed, was necessary for repair to take place. This was the understanding until it was shown that inflammation was due to a microorganism, in fact, that inflammation was a specific disease, and retarded or hindered repair.

Pasteur, of France, discovered that putrefaction was caused by microorganisms. The immortal Lister *applied* this knowledge to wound treatment. He believed that the processes taking place in an inflamed wound were akin to decomposition and were due to microorganisms existing in the air. He introduced the use of carbolic spray to kill the germs in the air and used antiseptics and antiseptic dressings to further prevent their entrance into the wounds. Upon trial it was at once seen that an enormous improvement in wound treatment had taken place, but Lister's theory lacked scientific confirmation. The painstaking research of Koch soon after confirmed the Listerian theory.

By means of solid culture methods he was able to isolate the various specific organisms of the inflammatory processes and to prove by scientific demonstration that they were the cause of inflam-

mation. By the combined labor of surgeons and pathologists all over the world knowledge of the relations of germs to disease rapidly accumulated. This led to many changes in the methods of carrying out antiseptic surgery, until now they are quite different from fifteen or twenty years ago, though the principles are the same. To the immortal Lister is due *all* the praise. Thus it was soon shown that the germs in the air were in smaller quantity and less likely to do harm than the germs on the hands of the surgeons, on his instruments, and upon the field of operation; and furthermore, that the carbolic spray did not kill those that were in the air. Accordingly the spray was abandoned and more attention given to the removal of germs from the skin and instruments by thorough washing and by the use of antiseptics. After a few years it was found that by a thorough washing of the hands and operative field all microorganisms could practically be removed, and that by the aid of heat the instruments could be rendered germ free. The use of antiseptics, therefore, became less common, especially as it was found that the antiseptics were somewhat irritating to the wound. And thus was inaugurated so called "aseptic surgery."

The knowledge possessed of the nature of repair and inflammation after the inauguration of antiseptics gave an unparalleled impetus to surgery. Surgeons formerly believing that inflammation and suppuration were a necessary sequence of operative procedures, naturally refrained from interfer-

ing with parts of the body, the inflammation of which would cause certain death. Thus they feared to attack the serous cavities or the organs contained therein, contenting themselves, with rare exceptions, with operating upon the surface of the body. When it was found that inflammation was due to germs which could be excluded from the field of operation, all was revolutionized and so **modern surgery was born.**

Fifty years ago wounds were closed by adhesive plaster or sutures, and without drainage. Lint saturated in oils was then usually applied to the wound. Liston used water dressings. Others allowed the wound to remain open and heal by "scabbing" as it was called. Drainage tubes were introduced by Chassaignac in 1860, and gradually **came into general use.**

No further advance of any importance took place until the introduction of antiseptics. Profuse suppuration was the rule. Surgeons, indeed, considered a discharge of thick, creamy pus an excellent indication that the wound was doing well and styled the inflammatory product "laudable pus."

Pyæmia, erysipelas and hospital gangrene were extremely common and the mortality proportionately high.

The mortality following major amputations was, in the pre-Listerian days, from thirty to fifty per cent.; now it is less than ten per cent. The death rate of compound fractures was, formerly, fifty per cent. Dennis has recently reported 1,000 cases, treated by himself, with a mortality from inflam-

matory disease of one-seventh of one per cent. Since the introduction of antiseptics all has been changed. It is now possible to make a clean wound heal without inflammation, and the inflammatory diseases are almost unknown. Indeed, hospital gangrene, so long the terror of the surgeon, is now extinct. In the last few years great progress has been made in the manner of closing wounds, which are now united in layers, muscle to muscle, fascia to fascia, nerve to nerve, etc., in such a manner as to preserve as far as possible the functions of the part.

When it is found impossible to close the wound for lack of sufficient integument, grafts of skin from other parts of the body are used to cover the wound. Reverdin, in 1869, introduced the method of transplanting small pieces of skin to granulating surfaces, such as ulcers, but it was not until recent years that the method of Thiersch, in which strips of the upper layers of the skin are employed, that it became possible to cover recent wounds with grafts. The nature of other parasitic diseases was also shown by the aid of the microscope. Thus tuberculosis, so long misunderstood, having been considered a constitutional malady practically impossible to eradicate, was now shown to be a disease due to microorganisms, and in its early stages a local affection which could be successfully attacked.

Having taken this brief survey of the progress of surgery in a general way, it may be of interest

to trace its evolution more at length in certain of its more important divisions.

Before the discovery of anæsthesia, transfixion methods were usually employed in amputation on account of the greater rapidity with which they could be performed. When the factor of pain was eliminated various "mixed flap" operations came in use, designed to furnish a better stump. Later, "conservative surgery" demanded that the limb be removed at the lowest possible point, and this was the practice until very recently. Modern surgeons amputate at whatever point is best for an artificial limb.

Surgeons formerly operated upon the scalp and occasionally removed fractured bone with a trephine, but they left the contents of the cranium alone. About the time that antiseptic surgery was being introduced great advances had been made in the physiology of the nervous system as applied to cerebral localization. It had become possible to locate cerebral lesions quite accurately, and antisepsis made it possible to attack the disease successfully. Between 1876 and 1879 MacEwen, of Glasgow, correctly located and successfully operated upon a cerebral abscess and a cerebral tumor. Both patients recovered. Victor Horsley in 1887 reported ten such cases. Since that time quite a large number of cases have appeared in literature.

In modern operations the trephine has largely given way to the chisel and saw, and instead of removing buttons of bone, it is more common to reflect flaps of bone and soft parts, and subse

quently to replace and suture the flaps. This is called the "trap door" or osteo plastic method, and gives better exposure with less damage to the parts. Surgeons in preantiseptic days occasionally removed pieces of fractured bone from the spine, but left the spinal contents alone. Now fractures and dislocations are operated upon in selected cases, and the membranes and cord attacked for hemorrhage, tumors, or pus. Horsley removed the first tumor of the cord in 1887. Surgeons of former times operated upon the chest wall, but feared to go to greater depths. Now the pleural and pericardial cavities are opened and drained, and occasionally the lung is attacked. Wounds of the heart have been successfully stitched up in the dog, and it has been proposed to attempt the same in wounds of this organ in man.

Formerly operators seldom went deeper than the walls of the abdominal cavity, and when they did go farther the result was usually fatal. Now the abdominal cavity is opened with impunity. Every organ contained therein can be operated upon to the extent of its physiological function. In operations upon the viscera above the pelvic brim since antiseptics, Kocher, Treves, Bull, Senn, Murphy and McBurney have contributed most largely to the advance. Resections of portions of the bowels for disease have become quite common, as have anastomoses between various portions of the hollow viscera. Thanks to the labors of Treves, MacBurney, Murphy and others, the nature of the inflammatory diseases of the appendix which so long

puzzled pathologists and surgeons is now understood, and this frequent disease is successfully attacked. The kidney is now incised or removed for stone or disease. The spleen is occasionally removed, its blood-forming functions being supplied by the lymphatic tissues elsewhere.

Strange as it may seem, mortality following operations for strangulated hernia has not been materially decreased by antiseptic methods. This is because the sac of a strangulated hernia is already infected by the passage of the germs through the walls of the constricted bowel. Between the discovery of anæsthesia and the antiseptic era the radical operation for hernia was performed by the subcutaneous methods, such as Wood's and Span-ton's. After antisepsis became established the open method which had long before been abandoned owing to the frightful mortality from sepsis, was revived. While the mortality fell to practically nil, relapses were the rule and surgeons became discouraged. Bassini, of Italy, about eight years ago devised an operation which is now universally admitted to be a success. Dr. Halstead, of Baltimore, independently devised an operation which is nearly identical with that of Bassini.

Tumors of the uterus and its appendages, formerly seldom attacked, and then with startling fatality, are now removed with little danger. The pathology of collections of pus in and about the tubes was, until the last fifteen years, misunderstood. It was supposed that the collection of pus was a cellulitis between the layers of the broad

ligaments. The fact that it was not understood prevented proper treatment. Through the work of Tait and others its nature was explained, and it was successfully treated by laparotomy. This treatment was a distinct advance; but still the mortality has remained very high. Progressive gynecologists are now operating through the vagina, with a greatly diminished mortality.

Antisepsis has been a great aid to the surgeon in the ligation of arteries. Much of the fatal secondary hemorrhage of old times was due to sepsis and improper healing of the wound. The use of the aseptic absorbable ligature has also contributed in no small degree to the greater safety of these operations today.

In 1892 Halstead, of Baltimore, first tied the subclavian artery in its first portion for an aneurism of the subclavian and axillary arteries. He had noticed that the records of preceding unsuccessful attempts showed that secondary hemorrhage usually occurred from the distal side of the ligature, and he thought this was probably due to the breaking down of the aneurism. Accordingly he tied the axillary and the subclavian and its branches, resected the clavicle and dissected out the aneurism. This was one of the greatest triumphs of surgery ever recorded, and well illustrates the advance that has taken place.

The treatment of varicose veins of the extremities has also undergone a change. Formerly they were not often operated upon, from fear of sepsis. After antisepsis was introduced, multiple ligation

and dissection methods were in vogue. These methods were tedious and usually unsuccessful. Trendelenberg found that by ligation of the terminations of the internal and external saphenous veins the disease could be cured. The evolution that has taken place in the treatment of diseases and injuries of the bone is also interesting. Thus tuberculosis was first treated by incision; later by amputation; still later the influence of conservative surgery caused resection to be substituted for amputation. Now, atypical resections and arthrectomies, taking away the diseased structures and no more, are preferred. Ununited or badly united fractures are now operated upon by an open wound with great success. This in the preantiseptic period was, of course, not attempted.

The better understanding of the pathology of cancer, together with the use of anæsthetics and antiseptics, has revolutionized the treatment of this disease. We are able to operate earlier than were our forefathers, we have been taught by the microscope what surrounding structures should be removed with the morbid growth, and we are able to take as much time as we like and thus be more thorough, and lastly we care very little how large a wound we make. This is well illustrated by comparing the old and new operation for cancer of the breast. While formerly only the breast, and perhaps not all of that, was removed with the growth, now the breast, the skin covering it, the pectoral fascia, pectoral muscles and the fat and glands of the axilla are all removed. By this method, for which

we are principally indebted to Halstead, the percentage of recurrences has fallen from 100 per cent. to probably 50 per cent. or less.

For many years operations upon goitre were considered unjustifiable, owing to the attendant frightful mortality from hemorrhage and sepsis. In 1862 Gross voiced the sentiment of the profession when he called it "horrid butchery." In 1871 Wm. Warren Green called the attention of the profession to an improved plan of operating. His method consisted in well exposing the tumor without cutting into it; then rapid enucleation with the fingers until the pedicle composed of the four thyroid arteries was reached. The pedicle was then transfixed and tied, and the tumor removed. He reported two successful cases, and subsequently operated upon several others successfully, in this country and in Europe. Although this method is an improvement upon the old, still it required consummate boldness and dexterity to successfully follow it.

Recent pathology has taught us that these tumors are encapsulated growths, the gland tissue proper surrounding the growth in a thin layer. If an incision is made through this thin glandular tissue to the tumor proper, it can then be rapidly shelled out and with very little hemorrhage. The gland is allowed to remain, doing away with the danger of myxœdema, which frequently follows the extirpation of this gland. By carefully studying the history of surgery for the past twenty five years one can see that while the phenomenal advance

has been due in some measure to improved technique, it has been mainly due to a better knowledge of physiology, pathology and bacteriology. These branches of our science have taught us when to be conservative, as in the treatment of tuberculosis of the joints, and when to be prompt and radical, as in the treatment of appendicitis or of extra-uterine pregnancy. We have learned to pay higher regard to physiological functions. While formerly the minimum amount of pain and danger only was considered, now we endeavor to preserve the functions of the part, doing as little damage as possible.

We have seen that recent advances in surgery have been due to a greater knowledge of various sciences, and we must not lose sight of the fact that this increase in knowledge has been made possible by better facilities for learning. Our schools and laboratories have never been equipped as they are now. Never have so much time and labor been expended upon the education of the surgeon. This augurs well for the future of.

